Proposal: Numeric Criteria Determination for Water Color

Attachment 1: Data Review -Water Quality Standards: Selected States

EPA 1976 ("Red Book") - Color
Criteria:
"Waters shall be virtually free from substances producing objectionable color for aesthetic purposes;
The source of supply should not exceed 75 color units on the platinum-cobalt scale for domestic water supplies; and
Increased color (in combination with turbidity) shall not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life".

Rationale:
The effects of color on public water supplies also are principally aesthetic. The 1962 "Drinking Water Standards" (PHS, 1962) recommended that color in finished waters should not exceed 15 units on the platinum-cobalt scale. Water consistently can be treated using standard coagulation, sedimentation, and filtration processes to reduce color to substantially less than 15 color units when the source water does not exceed 75 color units (AWWA, 1971; NAS, 1974).

The effects of color in water on aquatic life principally are to reduce light penetration and thereby generally reduce photosynthesis by phytoplankton and to restrict the zone for aquatic vascular plant growth. Light supply is affected by both intensity and wavelength, with rates of photosynthesis most affected by light in the red spectrum and least affected in the blue-violet region of the spectrum (Welch, 1952). Water color has the greatest effects on light in the blue end of the spectrum, with transmission of blue spectrum in highly colored (45-132 color units) waters greatly reduced, a 50 % reduction in yellow, and 100-120 % transmission of red (Birge and Juday 1930).

References:

American Water Works Association. 1971. Water quality and treatment. 3rd ed. McGraw Hill Book Co. New York.
Birge, E.A., and C. Juday. 1930. A second report on solar radiation and inland lakes. *Trans. Wisc. Acad. Science, Arts, Let.* 25: 285
National Academy of Sciences, National Academy of Engineering. 1974. Water quality criteria, 1972. U.S. Government Printing Office, Washington, D.C.
Welch, P.S. 1952. Limnology. McGraw-Hill Book Co., New York

Research: Data was gathered from several state water quality regulations regarding color standards (preferably numeric), as well information pertaining to the metric used and the justification for numeric criterion selection. The following states were examined:

1. Oregon
2. Washington
4. Virginia
5. Pennsylvania

3. Delaware 6. West Virginia
Note: NTU = Nephelometric Turbidity Units

State	Turbidity	Color
Washington	Marine Not to exceed 5 NTU over Background. If background < 50 NTU or not to exceed 10% increase if background ∃ 50 NTU	Marine Under (viii) Aesthetic values …offend the senses of sight Narrative Class AA and A Class B Aesthetics reduced by natural causes only
	Lake Not to exceed 5 NTU over background.	Lakes Same as Class AA and A
Contact	Mark Hicks 360-407-6477	mhic461@ecy.wa.gov
Oregon	General: 340-041-0245 Pursuant to ORS 468.735, 720, 990, 992; Notwithstanding …best practicable treatment and control of wastes… turbidities, color, odor… at the lowest possible levels. Also Basin-Specific Regulations and Guidelines D (c) NTE a 10% cumulative ↑ in natural stream turbidity as compared w/ control point measurement directly upstream from causal activity. Exceptions for emergencies, limited Legitimate Activities (dredging, construction) D Effluent limitations (k) Objectionable discoloration…. (l) Aesthetic….senses of sight, taste…	
Contact	Emma Djodjic 503-229-5990 DEQ Hdqrters 503-229-5696	
Pennsylvania	PA Code: General: 93.6 (b) In addition to other substances…. Which produce colors, tastes, odors, turbidity…. PA Code: Specific: 93.7 Table 3: Maximum 75 units on the platinum cobalt scale; no other colors perceptible to the human eye. Specific Use is PWS (public water system)	
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	Tom Barron Same #	tbarron@state.pa.us

Virginia

General: 9 VAC 25-260-20 Specific substances to be controlled include…; substances that produce color, tastes, turbidity….
Specific: 9 VAC 25-260-40 Color Units (15) for 4 physiographic provinces (Coastal, Piedmont & Blue Ridge, Valley & Ridge, and Cumberland Plateau) – Guidance Only

Contact

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West Virginia

General: 46-1-1 (46-1-3f) No sewage, industrial wastes …. materially contribute to any of the following conditions thereof:
3.2.f Distinctly visible color

Contact

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Chief, Water Resources

Delaware

General Stream Criteria: 4.1 (a) iii Waters shall be free… following: Any pollutants, including those of a thermal…may impart undesirable odors, tastes, or colors to the water… species.
In Zone and Boundary of Zone Water Quality Requirements
6.5 (b) iv Regulatory mixing zones shall be free of the following:
iv Substances in concentrations that produce color, odor, taste…or may cause a nuisance condition or.
11.5 ERES Waters a. iv. D Discharge to ERES Water, consideration and minimization of impacts
D. Impacts on recreational, aesthetic and economic values.
v. C. Permit Application requires a Resource Assessment.
Assessment shall fully consider ecological values and functions …
Potential effects on human use impacts… aesthetics…access areas.
12. Criteria for Low Flow Waters:
12.1 b. iv. The discharge shall not add… Substances in concentrations that produce color, odor, taste…

Contact

John Schneider 302-739-4691

Summary:

Two of the six states (PA and VA) had numeric criteria designations for specific and/or critical use designation, while the other four states gave only narrative guidance for water color. Summary of the numeric Water Quality Criterion:

1. Pennsylvania: Specific Use Criteria 93.7 of Title 25.93 of the Pennsylvania Code states that the Maximum Allowable Color is 75 units on the platinum-cobalt scale

(P/CS). Critical use is public drinking water supply. This correlates with guidance promulgated by the EPA in the "Red Book"(1976). **It was demonstrated that 75 units is the maximum allowable color for natural waters whereby conventional treatment processes can decrease the color to the maximum acceptable color of 15 units (P/CS) for potable water.**

2. Virginia: Specific Use Criteria 9 Virginia Code 25-260-40 states that as a guide, the maximum color for groundwater is 15 color units (P/CS) for the 4 physiographic provinces (Coastal, Piedmont & Blue Ridge, Valley 7 Ridge, and Cumberland Plateau). This number is not mandatory or enforceable, but rather to provide guidance for groundwater pollution prevention. Surface water standards are narrative only.

The method used by both states is ASTM Test Method D1209-00 Standard Method for Color of Clear Liquids (Platinum Cobalt Scale).

3. Communication was initiated with state water quality personnel from Delaware, Pennsylvania, and Virginia using the following points of contact:
   a. Delaware: Richard W. Greene (DE)
   b. Tom Barron (PA)
   c. Elleanore M. Daub (VA)

   Tom Barron (PA), discussed the rationale behind their determination of the numeric value for water color, discussed above in (1).